J Evol Econ (2012) 22:133–160
DOI 10.1007/s00191-011-0218-4

REGULAR ARTICLE

The origins of meso economics

Schumpeter's legacy and beyond

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Published online: 21 January 2011

Abstract The paper starts from Schumpeter's proposition that entrepreneurs carry out innovations (the micro level), that swarms of followers imitate them (meso) and that, as a consequence, 'creative destruction' leads to economic development 'from within' (macro). It is argued that Schumpeter's approach can be developed into a new—more general—*micro-meso-macro* framework in economics. Center stage is *meso*. Its essential characteristic is bimodality, meaning that one idea (the generic rule) can be physically actualized by many agents (a population). Ideas can relate to others, and, in this way, meso constitutes a *structure component* of a 'deep' invisible macro structure. Equally, the rule actualization process unfolds over time—modelled in the paper as a meso trajectory with three phases of rule origination, selective adoption and retention—and here meso represents a *process component* of a visible 'surface' structure. The macro measure with a view to the appropriateness of meso components is generic correspondence. At the level of ideas, its measure is order; at that of actual relative adoption frequencies, it is generic equilibrium. Economic development occurs at the deep level as transition from one generic rule to another, inducing a change of order, and, at the surface level, as the new rule is adopted, destroying an old equilibrium and establishing a new one.

Keywords Micro-meso-macro-framework · Mesoeconomics · Neoclassical versus evolutionary economics · Schumpeterian economics · Evolutionary ontology · Knowledge · Unified rule theory · History of economic thought · Schumpeter · Hayek · Marshall

JEL Classification B12 · B31 · B41 · B52–53 · L26 · M13 · O30

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1 Schumpeter's age

The twentieth century brought forth a number of great economists, among them Joseph A. Schumpeter. Yet, the work of none of these giants has attracted an interest similar to that of Schumpeter's over the last two decades. There are two main reasons for this. The first has to do with the growing impact his theory has had and is having on economics. As we shall argue, his simple proposition that entrepreneurs carry out novelty, luring swarms of followers, contains in its core an analytical category—we call it *meso*—that prompts a breakdown of the traditional distinction between micro and macro and aspires to the reconstruction of economics on a *micro-meso-macro* basis. The extraordinary and increasing interest in Schumpeter's work today, and likely in the foreseeable future, is part of what may be called a meso revolution.[1]

[1]The concept of *meso* takes on an intermediate position in the distinction between *micro and macro,* and hence presumes that distinction. The micro-macro distinction became popular after the publication of Keynes's *General Theory*, in which he demonstrated that the aggregates of individual decisions (micro) of a Walrasian or similar (neo-) 'classical' equilibrium was consistent with various states of the system when defined in terms of aggregates of other (macro) variables, in particular, employment, income and money volume. The present-day proponents of the so called "new" classical macro economics view the problem differently, but the important point here is that the established distinction between micro economics as dealing with Walras-type decision variables and macro economics as dealing with the mentioned aggregate variables has survived and is serving as a powerful taxonomic device and classifier for textbooks and teaching curricula in the discipline. This dichotomy did not exist at a time when Keynes was alive and when Schumpeter wrote his essay on Keynes. Schumpeter suggested calling "monetary analysis" or "income analysis" for what today is called macro economics, arguing that, "(s)ince the aggregates chosen for variables are, with the exception of employment, monetary quantities or expressions, we may also speak of monetary analysis, and, since national income is the central variable, of income analysis" (Schumpeter 1952/1997, p. 282). It is evident that the usage of the terms micro and macro economics is a mere convention and that we could employ with equal vindication Schumpeter's terminology, or a similar one, to denote appropriately the distinction between the two sets of variables. Evolutionary economists see no necessity to follow the conventional terminology and usually refer, when talking about *micro* economic analysis, to firms, households or behavioral routines, and when talking about *macro* economic analysis to the division of labor and knowledge or static and dynamic relationships between aggregate magnitudes.

The term *'meso'* emerges as constituent concept, as we shall see, from an evolutionary perspective that defines micro and macro in this way. At this juncture, it is noteworthy that there is an impressive basket of all kinds of meso studies. The contributions to this large and growing research area include works on life cycles by Klepper (1997) and Grebel et al. (2006), on the entrepreneurial core of a meso-based economics Baumol (1968), on institutionally embedded Schumpeterian entrepreneurship Ebner (2002, 2010), on the co-evolutionary (technology-institution) dynamic by Nelson (2005), on modelling industrial evolution by Winter et al. (2003), on Schumpeterian competition by Winter (1984), on selective adoption and self-organization by Gowdy (1992), Foster (2000), and Knudsen (2002), on the historicity of industrial evolution by Malerba et al. (1999), on path dependence by David (2005), and Arthur (1989), on organization and innovation dynamics by Grebel (2009), Werker and Athreya (2004), Malerba (2006), Audretsch (1995), and Cordes (2005), on technical systems by Carlsson and Stankiewicz (1991), on heterogeneity, networks and industrial innovations by Cantner and Krüger (2004), Saviotti and Pyka (2008), Elsner (2010), and on methods and modelling building blocks Safarzyn'ska and van den Bergh (2010), to mention but a few from a rich set of important contributions.

The second reason the game belongs to Schumpeter is closely related to the fact that his work can provide, as that of no other economist, solutions to the most pressing problems of our times. His approach appears to be tailor-made when calling for solutions to the complex problems of a highly dynamic, innovative knowledge-based economy. This view is paralleled by the recognition that his work provides guidance for economic policy (Hanusch and Pyka 2007a).

This paper attempts a fresh look at Schumpeter's theoretical edifice. The purpose is not to give a comprehensive or complete account. There are magisterial works providing exactly this, for instance, by Stolper (1994), Swedberg (1991), Perlman and McCann (1998), Shionoya (1997), and Andersen (2009). Instead, we investigate the theoretical corpus of Schumpeter's economics with a view to examining the skeleton, which, through our analytical screen, will turn out to be *micro-meso-macro*. Building on Dopfer (2001, 2005), Dopfer et al. (2004), Dopfer and Potts (2008), we shall, on the one hand, unveil the generic architecture of economics as inspired by Schumpeter's work, and, on the other hand, discuss Schumpeter's specific theoretical positions against this background. Turning to the latter, we shall not draw only on Schumpeter's theoretical work directly, but also try to get an understanding of his theory by looking at the way in which he criticizes competing positions, in particular those of classical and neoclassical economics. This will provide us with an idea of what Schumpeter thought a good theory to be. Schumpeter inspired the construction of a *micro-meso-macro* framework, and an important further question will be how he scored in terms of filling it with valid theoretical propositions. Pursuing this line of enquiry, the contours of a *unified evolutionary program for economics* will emerge.

2 The benchmark

The assertion that Schumpeter triggered a meso revolution invites a discussion as to the benchmark used. In fairness, we mention here that the reader should be prepared to make some production detours, much in the sense of Böhm–Bawerk's capital theory, in order to arrive at a reliable benchmark for assessing Schumpeter's work. As in any venture of this kind, the outcome is uncertain and the reader is invited to accept the role of a risk taker.

A principal benchmark relates to the boundaries of the discipline, and we may all agree that what lies outside will not qualify as scientific advance in economics. This sounds much like a tautology, but it is instrumental in that it obliges us to specify these boundaries. Here, we would expect that mainstream economists and students of Schumpeter hold quite different views.

While it may, in general, be difficult to agree on what economics is all about, there may be considerably more agreement on what it is not. This suggests that we frame our definition of economics in a way that we

can state explicitly what we do *not* consider as within its scope. Acknowledging this criterion of exclusion, we define *economics as the science that studies the causes and consequences of the behaviors of many individuals dealing with commodities in a macroscopic system*. We contend that this definition is all-inclusive, and that it allows us to exclude sufficiently what economics is not. First, the disciplines of psychology and sociology both deal with human behavior, but they do not relate it in any systematic way to quantities, prices and other attributes of commodities. They differ from economics, not because they abstain from dealing with rationality (they often do), but because they do not generally deal with commodities. By implication, the rationality assumption alone does not qualify an enquiry as an economic one. Second, physics and the technical sciences deal systematically with objects, but these objects are not yet commodities. They *become* commodities when they are related to a value measure, as, for instance, in the subjective and objective value theories of economics. Finally, the management sciences are not economics. This appears as quite evident, but it is not always recognized that Lionel Robbins' often cited definition of economics as the science that deals with the relationship between ends and scarce means which have alternative uses fails to acknowledge exactly this. Managers and management scientists alike will consider Robbins's problem as theirs, but they will relate it to the firm, not to the economy as a whole.

3 Conventional economics revisited: the operant level

Our definition of economics has introduced the key categories of individual(s) and commodities, and a principal question centers on how these connect. In mainstream economics, the connection between the two is established on the basis of decision theory. Classical economics, in turn, describes production and consumption on the basis of objective laws. It operates with aggregates, but micro phenomena may be inferred by way of dis-aggregation, and the individual units conceived in their specific economic activities as producers and consumers—a distinction not endogenous to neoclassical economics which, ex post, has to specify institutionally the areas to which the decision calculus applies. Finally, institutional economics deals with transactions, and the focus is usually not on a single transaction but on repeated ones, which calls for an explanatory account that individual decision theory cannot offer. There is quite an array of theoretical approaches to deal with the connection between individual and commodities.

The issue is whether it is appropriate to single out a particular approach, and then to assume its universality. As is well known, this is the research strategy that neoclassical economics has adopted when postulating that decision theory can serve as a universal platform for the solution of all theoretical

problems. There is a similar tendency of assuming universality also in the other approaches, but we reject all these claims on grounds that they deal only with a special, not general, aspect of economic reality. Let us assemble the various special aspects and refer to them generally as *operations.* We say, then, that individuals *perform operations* (or operate) in a *commodity space.* Individuals connect with commodities by operations.

Operations are *domain-specific;* and, as such, they refer to the domains of production, consumption and (market) transaction. Individuals perform, for example, the operation of production. Within domains, operations are *action-specific;* and, as such, they refer to decision making as well as to the search of information or to organizing social and technical entities. For instance, individuals are said to perform the operation of organizing in the domain of production. All operations performed in the commodity space can be described on the basis of domain- and action-specificity.

The term "operation" makes sense only when related to "commodities." To be effective, operations require that there are opportunities. These represent a *pre*-operational state of the commodity space. Second, operations lead to outcomes in terms of a commodity reallocation or redistribution. These outcomes denote the *post*-operational state of the commodity space. All commodities are either in a pre-operational state (as opportunities, under constraints) or in a post-operational state (as outcomes). All operations, in turn, are specified by a combinatorial, stated in terms of domain- and action-specificity. The static and dynamic properties of the system can, in this way, be derived completely from statements about the (pre- or post-operational) state of the commodity space and the dual specificity of operations.

Let us take stock. Economics studies individuals as they deal with commodities. To connect the two, the concept of "operation" has been suggested to serve as a connecting principle. The various theoretical approaches specify the general principle quite differently, and much of the competition among economic theories takes place on the plane of claiming a superior specification of operation. For instance, mainstream economics claims its superiority by emphasizing that its decision theoretic basis is universal, and institutional transaction approaches try to score on grounds that they are realistic. These are important issues, and much of theoretical progress in economics will depend on coping with them adequately.

However, the whole theoretical corpus rests on a set of presumptions. It is tacitly assumed that operations are useful, since, otherwise, they would not be performed; but why should they be useful? What furnishes operations with a rationale in the first place? If this issue is settled, how then are individuals in a position to perform operations? What factors account for their ability to do so? These questions relate in a fundamental way to the scope, content and extent of the operations in the commodity space, but the theoretical answers they prompt lie at a different level. In contradistinction to the operant level, we have what can be called a *generic level* composed of a *set of variables explaining*

operations and changes in the commodity space.[2] In that sense, it is important to acknowledge that there are two different levels of an economic system. They are, respectively,

operant level
generic level.

The primary interest of evolutionary economics and of its various strands, such as Neo-Schumpeterian economics, lies in the analysis of the generic level. An inquiry into that level provides us, first of all, with a cue as to why operations are necessary and why they are possible.

4 From operant to generic analysis

The issue of the necessity of operations relates intrinsically to the phenomenon of *entropy*. Humans and their cultural systems, of which the economy is a subsystem, are *living* systems, and, as such, they are *thermodynamically open*.[3] To survive, to develop and to evolve, human systems require maintenance of a temperature difference from that of their environment; they are equipped with a metabolism (besides respiration) that transforms nutritional intakes, allowing them to maintain the required temperature difference. The archecortical areas of the brain not only regulate the metabolic transformation, but they also provide a signalling device in the form of hunger that drives them to eat in order to avoid the consequences of entropic decay. Economically, this means that humans have *needs* which they must *satisfy on the basis of economic operations*. The consequences of the entropy law are effective not only at the biological, but also at the level of activities that we associate with human culture. Machines, buildings, cars or instruments all degrade and require maintenance, repair and replacement. There is an absolute necessity—a need—to perform operations in order to avoid economic loss. Operations

[2]The term operant has been associated with a 'Commodity Approach'. The term 'generic', in turn, shall denote the set of slow changing or 'classical' variables; these are typically kept constant in neoclassical economics.

We are of course free to choose any term, but we think that the use of the stem 'gen-' has the advantage of embracing various meanings that are relevant for our analysis. The term 'genetic' is used in biology in reference to biological information, but we are interested only in the general aspect of information (gen), not in its biological specification (-etics, or gen-e). The stem 'gen' can be also associated with the terms 'genesis' or 'generation'. The use of this meaning of the word stem is relevant for our analysis when dealing with change, for instance, when discussing the generation of novelty. While it would be sufficient to call this level simply X-level, we think that the neologism 'generic' can additionally provide a substantive meaning in that it can be associated in its stem generally with information, but also allows us to distinguish biological information (gene, genetic) from social and economic information (generic rule, generic analysis), and because the generality of the word stem allows us to include other relevant meanings, such as (rule) generation.

[3]The entropy law applied in its wider sense states that all physical phenomena follow an irreversible course from order to chaos; chaos denoting here non-order, without the predictive connotation of the chaos models. See Georgescu-Roegen (1971).

are, in an absolute, entropic sense, governed by needs. Different humans may have different preferences as to how they satisfy their needs—for instance, one person prefers wine, another beer—but they both share the need to drink something. There may similarly exist a variety of instrumental devices that serve a specific productive purpose, but they all must be designed to counter entropic loss.

We have highlighted the necessity of operations, and the question now is how these are possible. The evolutionary response to the thermodynamic challenge, or rather chance, is *knowledge*. It would be wrong to interpret this as meaning that knowledge solves only the entropy problem, since this would mean that evolution has stopped at the lowest level possible. The hallmark of knowledge is that it *can generate new knowledge that, in turn, generates new knowledge,* and so forth, self-perpetuating a continuous path of cumulated knowledge growth. In contemporary economics, this knowledge accumulation has been applied to objects and developed into an elaborate capital theory. Organisms have evolved biological knowledge on a massive scale and with increasing variety at the level of genes and genomes. Economics is interested in biology only insofar as the brain of *Homo sapiens* represents a product of biological evolution. *Homo sapiens* moves also in economic contexts, and we get—taking methodological realism serious—the construal of *Homo sapiens oeconomicus*.[4] The upshot of *Homo sapiens oeconomicus* is that it has the extraordinary ability continuously to generate, to adopt and to retain new knowledge. Operations and commodity space are subject to permanent endogenous shocks and generally are highly unstable. For formal-analytical purposes, it is helpful to keep knowledge constant, but this means ignoring a most characteristic feature of economic reality.

Generic analysis does not deal with the problem of how operations are performed, but rather inquires into the nature of the knowledge base that enables such performance by agents. Keeping the knowledge base constant, the operations and induced changes in the commodity space can be analyzed. For instance, the optimum of a relative choice on the locus of an indifference or iso-cost curve and its consequences with a view to a restored allocation equilibrium can be ascertained. The central categories in this type of analysis are operations and opportunities. In generic analysis, we do not have opportunities that are consumed by operations, but rather have knowledge potentials that are actualized for operations. To be precise, we have ideas, which turn into knowledge when they are actualized by an agent. Knowledge is a carried idea. The differences between the operant and generic levels and analyses can be summarized as follows:

Operant level :	Commodities	Opportunity	Operations
Generic level :	**Knowledge**	**Potential**	**Actualization**

[4]For a more detailed discussion on the cortical areas and generic capabilities of *Homo Sapiens Oeconomicus*, see Dopfer (2005).

We may conclude that an economic theory that claims completeness must deal with both the *operant* and the *generic* level. What, then, are the specific questions of economics?

5 Coordination and change

All sciences resemble one another in that they deal, on the one hand, with relationships among elements, and, on the other hand, with the behavior of the whole over time. Economics is no exception, and, most generally, the questions of economics are how the economic activities of many individuals are coordinated and how the economy changes over time.

The birth of modern economics in the second half of the eighteenth century was largely a response to two grand revolutions which have left particular historic marks on the general questions of coordination and change. The first revolution was a *politico-economic* one, and brought individuals varying degrees of freedom in their operations. The founders of the discipline had a natural curiosity with respect to the theoretical treatment of coordination under conditions of a free, rather than regulated, market economy (as had prevailed in the *ancien régime*). The other revolution was *technological–industrial*. Epochal inventions, such as the steam engine and the mechanical loom, led to a path of unprecedented economic growth and broad structural change. Both the bourgeois–liberal and the technological–industrial revolutions set the stage for economics as a modern science. In a metaphoric nutshell, economists gained interest in the "invisible hand" (Smith) and, in the forces that changed by "creative destruction", the economy "from within" (Schumpeter).

The two grand disciplinary questions inspired various theoretical answers. From the view point of the history of theory development, we can broadly distinguish between classical and neoclassical economics. In the following, we shall first briefly discuss Schumpeter's "vision". We shall see subsequently that his vision not only guided him in the construction of his own theory, but also in the assessment of the works of others.

6 Schumpeter's vision

Schumpeter's life long scientific concern can be encapsulated in the question: what determines change in social life? His straightforward answer was: energetic personalities. By 'change' Schumpeter did not mean change in ongoing social life under given conditions, but rather change in these conditions themselves. This type of change involves new ideas, and in this way makes the energetic agent an innovator. The primary 'agens' of change is the energetic drive of the individual, and new ideas are his powerful tool. An

agent who brings about change in social life by introducing novelty is termed an *entrepreneur* by Schumpeter. All important change, whether in political, economic or cultural life, is brought about by entrepreneurs. The notion of the entrepreneur is an archetype for a primary source of energy that changes social life.

7 The received doctrines

Schumpeter translated this vision into a powerful theory of economic change with his entrepreneur granted center stage. He missed few opportunities to make it clear that a theory that failed to acknowledge the central role of the entrepreneur was fundamentally flawed.

Using this lens, Schumpeter brought the works of the classical and neoclassical economists into sharp focus. The proponents of the classical doctrine worked with aggregate resource magnitudes, and they proposed looking for objective laws in their relationships. The activities of individuals had no role to play in this objective machinery, and were at best epiphenomena, explained by, but not explaining, the aggregate relationships. Schumpeter, for one thing, objected to the view that all economic development was bound to terminate in a secular stationary state. In this way, David Ricardo and Thomas Malthus conceived economic development as a process whereby population increases led to decreasing marginal returns from agriculture, collapsing eventually into the stationary state of a secular subsistence equilibrium. This 'dismal vision' enjoyed a revival in the works of the stagnationists of the times, who held—confirming the predictive conjectures of their classical precursors—that "the capitalist system has spent its powers, ...that our economy is, amid convulsions, settling down to a State of Secular Stagnation" (Schumpeter 1952/1997, p. 570). Contemporary authors such as Alvin Hansen failed, in Schumpeter's view, to recognize that individuals had the power eventually to counter the alleged immanent objective forces, and that these could never force the system into a secular stationary state.

Schumpeter's objectivist critique was not targeted specifically at the stagnationists, but included all strands of the classical canon. His critique did not concern the particular direction of the developmental course, or the differences in weight given to its determining factors, but merely the notion that economic change could be explained on the basis of objective laws. The nature of those laws was irrelevant—that is, they could be associated either with entropic forces or with new ideas and knowledge growth. For Schumpeter, the essential point was that development was always propelled by the 'agens' of the entrepreneur, and that "in technical or organisational progress there is no autonomous momentum which carries in itself a developmental law, which would be due to progress in our knowledge. [...] There is no automatic progress" (Schumpeter 1912/1926, p. 480). From his anti-objectivist platform, Schumpeter issued an indictment of several authors, such as Friedrich List,

but the central target was Smith. There is "nothing original" in his writings, Schumpeter says, except that

> .....nobody, either before or after A. Smith, ever thought of putting such a burden upon division of labour. With A. Smith it is practically the only factor in economic progress. [...] Technological progress, "invention of all those machines"—and even investments—is induced by it and is, in fact, just an incident of it..... Division of labour itself is attributed to an inborn propensity to truck and its development to the gradual expansion of markets ..... It thus appears and grows as an entirely impersonal force, and since it is the great motor of progress, this progress too is depersonalised. (Schumpeter 1952/1997, p. 188)

Schumpeter highlighted innovations as the central driving force of development, and Smith analogously emphasized the power of innovations unlike any other classical writer. It was, arguably, precisely this close congeniality that prompted Schumpeter to take Smith's work as an exemplar for demonstrating the essential difference between his and the classical approach.

8 Methodological individualism

Neoclassical economics ushered in a wind of change. In Schumpeter's view, it introduced a major innovation by acknowledging that the individual agent was central in the formation of economic theory. Its pioneers, such as Léon Walras, Stanley Jevons, Heinrich Gossen and Vilfredo Pareto, understood that a proper theoretical account of economic phenomena was inconceivable on the basis of objective laws, but was bound to be premised on an understanding of individual cognition and behavior. Schumpeter did not merely endorse this view, but also made a significant contribution to its methodological underpinnings. Inspired by the writings of Carl Menger, he introduced into the project 'methodological individualism'. He gave a name to what already united the neoclassical writers and what made them distinct with respect to their classical precursors.

The question that arises is whether Schumpeter actually belongs to the neoclassical camp. After all, he is usually considered to represent a major heterodox figure of contemporary economics. A look at the origins of the concept provides us with the essential cue. The neoclassical economists set out to solve the problem of Smith's "invisible hand". The problem was static, and Pareto's construal of *Homo oeconomicus* was designed to serve this purpose. *Homo oeconomicus* only reacts to opportunities, but in no way changes them. Schumpeter's theoretical problem, in turn, was not static, but dynamic. *Homo oeconomicus* was designed to solve the problems of static analysis, and, because it was successful in doing so, it proved inherently inappropriate for solving the dynamic problem.

It is here that Schumpeter's entrepreneur enters the scene. Methodological individualism can thus be interpreted as having two distinct components: one

that deals with passive (neoclassical) individual behavior, and another that deals with active (Schumpeterian) individual behavior. There is, in this way,

– **passive** methodological individualism, and
– **active** methodological individualism.

While Schumpeter was not explicit with regard to this distinction, he left no doubt in his writings that neoclassical economics was flawed because it featured only passive methodological individualism—ignoring its active counterpart. Schumpeter was not only an innovator with regard to the concept of methodological individualism; he also completed it.

9 Methodological individualism goes generic

The complete form of methodological individualism allows us to view the agents not only as responding to given opportunities, but also as engaging actively in the economic process. This, however, can be given two meanings. Agents can engage in activities at the operant and at the generic level. The hallmark of Schumpeter's theoretical proposition is that the active agent engages not only in activities at the operant, but also at the generic level. The entrepreneur carries out innovations, and, in this way, changes the generic knowledge base of the economy. There will be changes in the operations and the commodity space, but these are induced by changes in generic knowledge.

The significance of Schumpeter's proposition is apparent, if we contrast the agent who is active at the operant with the one who is active at the generic level. Austrian economics is a good exemplar, since it deals with both. We can distinguish between a 'standard' operant and a 'progressive' generic model of this strand. The Austrian standard model, as advanced by Mises, Lachmann and, most clearly, Kirzner, rejects the orthodox assumption that agents possess all relevant information for operations. Instead, it conceives individuals as being actively involved in the search and discovery of operational information. The search activities of individuals result in the discovery of new opportunities, leading to arbitrage profits and rents. Advanced neoclassical models include in the decision function information search costs, but the Austrians highlight the involvement of the agents in an open process in which marginal equivalences of information costs and benefits can never be known in advance. There is Knightian uncertainty even at the operant level. Essentially, the Austrians do not build their theoretical reasoning on decision logic. However, the Austrian standard and neoclassical models share common ground in that they are both confined to the operant level of an economy. The search for information does not relate to generic knowledge, and, in the occasional passages where this is considered, the theoretical consequences are not worked out systematically. In contrast, Schumpeter's entrepreneur searches and introduces into the system new generic knowledge. Here is the watershed between Schumpeter's approach and those that deal with the operant level.

The distinctions between active and passive individuals and between operant and generic levels yield a 2 × 2 matrix that is useful for clarifying the multi-faceted concept of methodological individualism and for demonstrating in what theoretical fields they can be employed. In a more speculative mood, we can conceive the various items of the matrix as steps of a ladder that signals theoretical advance as we ascend it.

* In a first step, theories work with *aggregates*, and Schumpeter provided good reasons why their explanatory power is limited.
* In a second step, individuals are introduced but, being born as *homines oeconomici*, they only *respond* to given opportunities rather than create them.
* In a third step, individuals equipped with *Austrian* genes become *active* and can arbitrage profits.
* In a fourth step, the perspective is further extended bringing us onto the *generic* level. Here the *Schumpeterian entrepreneur* is active.

With respect to theoretical advance, the ladder suggests that various building blocks are added one after the other to an existing theoretical corpus. But, by doing so, this can also imply that the whole structure and fundamental characteristics of that corpus changes. In the following, it shall be demonstrated that Schumpeter's insights can be developed into a more general *generic architecture* of economics.

10 Meso economics

The story, alluded to already is simple. The entrepreneur carries out innovations, and, by doing so, destroys and creates anew the structure of the economy "from within". The Schumpeterian entrepreneur introduces new knowledge, reconfigures generic rules, and enables agents to use a new set of operations inducing a reallocation in the commodity space. These propositions, in themselves, do not yield a theory of the economy, but they do furnish the material from which the elementary theoretical unit can be built.

We start with an *'idea*' and its '*actualization'* by many agents. Ontologically speaking, we have "oneness" and "manyness". Ideas are time- and space-less. They are potentials that can be (*qua* idea) actualized. Knowledge—defined as ideas 'carried' by agents—does not degrade if used; in fact, the use of ideas is instrumental for maintaining a store of knowledge. Opportunities, in turn, are consumed. An idea is physically actualized by (possibly) many agents in time and space. A single agent is a member of a population of agents that actualize an idea. This all sounds very philosophical (and rightly so), but it is of immediate practical relevance for theory formation.

Theoretically, we look for an *elementary unit* that can explain *structure and process* at the generic level. Conventional economics takes the individual as a micro unit, and constructs macro types by aggregation under restrictive

assumptions. This course is foreclosed in the present case. To explain actualization, we must acknowledge both the population and the individual (as the micro unit). We cannot categorize this as either macro or micro, since it is a generic conceptualization. Within the micro-macro dichotomy, the unit proposed is homeless; it is an intermediate category that gets its place as *meso*. Schumpeter's depiction of entrepreneurs adopting new technological and/or organizational rules that spread and become generic are of this character, and it is no surprise that they are invisible in standard economic theory. Schumpeter himself, as a scientist, deserves the attribute of entrepreneur, since he "creatively destroyed" the traditional framework of the discipline "from within". He set in train a new architecture for economics that is *micro-meso-macro*.

How, then, can meso explain generic structure and process? The key is *bimodality*. There are, on the one hand, ideas, and, on the other hand, matter-energy that is actualized in time and space. To explain structure, we require a definition of its component parts in terms of quality. Quantities can be aggregated, but cannot define the component parts of structure (Potts 2000; Foster 1987). It is perhaps painful for economists, who are used to thinking so much in quantities, to recognize that the only valid expedient here is the recourse to ideas. There is a high degree of abstraction with this ontological term, so let us define it in more specific, analytical terms. Clearly, ideas relevant for economic analysis are a specific manifestation of this ontological abstraction, that is to say, ideas that are contained, for instance, in a picture hanging on the wall are not relevant, but ideas that can be employed for economic operations are. We call any idea that represents a deductive format for economic operations a *rule*.[5] The structure of an economy can thus be conceived as a rule structure. To be 'real', rules must be physically actualized (with matter-energy) in time and space. Thus, the rule component represents a process, and the rule structure constitutes a process structure. We shall define subsequently this process in terms of a three phase rule trajectory, which shows how rules are created, adopted and retained. At this point, it is important to recognize that rules *qua* ideas are the analytical units that allow us to deal with economic *structure,* and that physical actualizations are the analytical units that allow us to deal with economic *process*. In combination, we get an *integrated elementary unit* that can serve as an instrument for the description of both structure and process of an economy.

The term meso is employed variously in economics and other sciences. This is indisputably an advantage since, in this way, the term becomes a member

[5]For a rule approach, see Holland et al. (1986). Our unified rule approach resembles in many ways that of Holland, et. al. However, it differs in that it introduces a rule taxonomy distinguishing between subject rules (cognitive, behavioral) and object rules (social and technical organizational). It, further, introduces a multi-level (micro-meso-macro) co-evolutionary dynamic between the two with a view to explaining the static and dynamic of the economy as a whole. *Rules* and (rule) *carriers* are the primary analytical units of the *generic* level of the economic system.

of natural scientific language and so we do not require any word coinage. Its broad inclusiveness, however, calls for a clear specification of the term if it is to be useful scientifically. The term meso has been used often in instances in which a reference to micro or to macro seemed inappropriate or ambiguous, as, for instance, in the areas of industry, sector or technology studies. The use of the term meso in these studies is of obvious *practical* relevance, and the clarification of the term that we attempt here will provide these investigations with additional analytical rigor and precision.

We encounter a different problem if we employ the term meso in the context of *theory making*. Here, the term serves as a conceptual building block in the construction of a theoretical edifice, and it derives its meaning from a specific task in a theoretic whole. We have seen previously that meso cannot be derived by simply aggregating micro units, and that, therefore, conventional economics cannot capture meso. But this is evident; both approaches seem ontologically worlds apart. More interesting is the case in which approaches resemble each other and qualify as what may be interpreted as *quasi-* or *proto-meso* approaches. These approaches may offer theoretic elements that can be integrated into the meso approach proposed, and, if ruled out, they will help us to draw the boundaries between the approaches more clearly. Let us take up as important cases first classical, then Marshallian economics.

Classical economics approaches meso with its concept of natural and actual price. The natural price is the market price under 'normal circumstances' to which the prices of all commodities are continuously gravitating. Particular circumstances may keep the actual market price above the natural price. We may interpret this in a way that these particular circumstances represent an introduction of a novelty, and the entrepreneur has (as monopolist) an innovation rent. The actual price would then initially differ from the natural price. Subsequently, there would be a tendency of the actual price to gravitate to the natural price. This is a good approximation of what indeed can be observed in real economies. However, the classical economists interpreted this differently. First, they reckoned, under the particular circumstances that cause a price deviance, factors such as natural disasters, governmental regulations or organized monopoly power, but they did not make any systematic reference to technical (or other) innovations. The natural price represents a static datum, defined by the market form of competition. This market form itself is supposed to be given and is not seen as the emergent outcome of a meso process. Furthermore, individuals are not introduced into the theory, and in fact are not required, given the objective 'law of gravity'. However, the dynamics of meso can be explained only on the basis of a process of interactions among individuals and not in terms of a commodity aggregate attracted by a center of gravitation. The deficits of the theoretic construct show up in essentially two ways. On the one hand, there is no explanation of the dynamics of market forms, which figured prominently in Schumpeter's work (e.g. Schumpeter 1939). On the other hand, the classical model fails to tackle adequately major aspects of the meso process, such as diffusion, macroscopic adoption, selection and path dependence.

Another important case of quasi-meso is provided by Marshall's distinction between short and long run demand and supply schedules. Marshall introduced time into economic analysis, and showed how equilibria shift over time due to certain factors. These include economies of scale internal to an industry, demand shifts, and classical factors such as population and capital accumulation. Technological progress again figures not as a key factor. There is no systematic assumption about an initial innovation that evolves along a technological or other knowledge trajectory. A difference from the classical canon, however, exists in that Marshall employed methodological individualism. This provides an explanatory potential, but again, when specifying the concept, he introduced the construct of the 'representative firm'. An account of meso relies crucially on the premise of heterogeneity of agents. Schumpeter's distinction between the entrepreneur and the 'statische Wirte' (e. g. managers) is an exemplar for this essential kind of heterogeneity in meso. As a consequence, Marshall failed to explain the meso process, and his analysis eventually drew on classical factors and the operant notions of elasticity and shifting schedules. There are objective determinants on the one side, and shifting quantities on the other, but no generic process. Marshall had an evolutionary vision, and from all what we know about his life, he was frustrated when attempting to match it to his actual work.

11 Schumpeter's meso

Schumpeter challenged the received doctrine with his simple proposition that entrepreneurs carry out innovations that are then adopted by a population of followers. This proposition led to an elementary unit that is composed of, on the one hand, an idea, or generic rule, and, on the other hand, many physical actualizations of it. The idea can serve as structure component, the set of physical actualizations as process component. The bimodal nature of the elementary unit breaks up the traditional micro-macro dichotomy, and, introducing meso, leads to the new framework of micro-meso-macro. While this in itself is a significant contribution to economics, the question of further interest is Schumpeter's particular contribution to the multi-facetted concept of meso.

As structure component, meso relates necessarily to the whole of structure, and we shall take up Schumpeter's contribution in the subsequent section on macro. As process component, meso deals essentially with the individual agent and a population of adopters of which he is a member. An idea or generic rule is actualized along a three-phase trajectory of origination, adoption and retention. To ease the discussion of Schumpeter's contribution, we shall subdivide each of the three phases, specifying the trajectory on the basis of six (sub-) phases. In the initial phase of origination, the distinction is between the creation and the discovery of a new idea. In the next phase of adoption, it is between the first and the many following adoptions, and in the terminal phase of retention, the distinction is between stabilizing and destabilizing forces

determining the generic rule regime. The six phase dynamic was introduced originally as a schema for a comparative theory study which included neo-classical, Austrian and evolutionary-Schumpeterian economics (Dopfer 1993). In the following, the discussion shall be confined to the contribution that Schumpeter made to the theoretical elucidation of the six trajectory phases. These can be summarized as follows:

I Origination

Sub-phase 1: creation of novel idea, i. e. invention
Sub-phase 1: search, discovery and recognition process, microscopic selection

II Adoption

Sub-phase 3: first adoption, i. e. innovation, chaotic environment, bifurcation, uncertain outcome
Sub-phase 4: macroscopic adoption of 'seed', selective environment, path dependence

III Retention

Sub-phase 5: retention of adopted 'seed', meta-stability of actualization process
Sub-phase 6: existing regime as breeding ground for novel potential(s), link to phase I.

Schumpeter's key contribution lies in the analysis of the (sub-) phases 2, as well as 3 and 4. The *locus classicus* of his analysis is phase II. In sub-phase 3 (first phase of adoption), the entrepreneur carries out a new combination, changing the environment by initiating a new meso trajectory that eventually gains momentum in sub-phase 4 (second phase of adoption). The latter is generally a population process which can be specified theoretically in various ways. Schumpeter focused on the dynamics of capitalist market forms, such as monopoly, oligopoly, and competition, and discussed their welfare and societal consequences. Neo-Schumpeterian economics has an explicit population core from which diffusion, selection, path dependence and related models can be developed and the original market dynamic integrated. A further link is between Schumpeter's adoption phase II and sub-phase 2 (second phase of origination), which displays the entrepreneurial activities with regard to search and discovery of new ways of doing things.

The lacunae in Schumpeter's work are sub-phases 1 as well as 5 and 6. In all his work, Schumpeter emphasized that it is not the creation, but the carrying out of new ideas that is relevant for coping with the phenomenon of economic development. "There are always changes in an economy, and we are not closer to the exhaustion of possibilities today than we were in the stone age" (Schumpeter 1912/1926, p. 161). While this is a reasonable conjecture, it does not provide us with an appropriate micro foundation for a theory of a knowledge-based economy in which the creation of knowledge is a pivotal

factor and requires theoretic recognition. The failure to explicate sub-phase 1 is a major theoretical deficit in Schumpeter's work, as Witt aptly remarks (Witt 2002).

The second lacuna refers to phase III, which essentially deals with institutional factors. Schumpeter refers to institutions and related factors occasionally, for instance, when arguing that habits are "hammered in", but he fails to deal with phase III systematically. Significantly, meso builds on the notion of circularity between individual and population. The trajectory dynamic unfolds not as a diffusion of a single valued variable, but rather as a process in which individuals interact with an emergent population in a self-reinforcing way. Veblen analyzed this process on the basis of his concept of circular and cumulative causation. Schumpeter criticized Veblen's work on the grounds that it was non-theoretical and sociological.[6] But there is a deeper reason for this, rooted in his view of causality. Unlike Veblen, he outlines a linear causality principle:

"We speak of cause and effect only in the case of an irreversible causal relationship.... In contrast, we do not speak of cause and effect in those instances where we have a reciprocal relationship between two facts. We consider as a cause of an economic phenomenon only its explanatory principle (Erklärungsprinzip), that is to say, that aspect that allows us to comprehend the nature (Wesen) of the cause." (Schumpeter 1912/1926)

This causality principle is straightforward in that, for instance, the creation of novelty comes before its being carried out, or mass adoption follows innovation, endorsing generally the logic of irreversibility that underlies the trajectory dynamic. Various types of models, particularly wave or cycle models, can be built on this basis. In a Kondratieff model, innovations may be viewed as the causal inception of an emergent dynamic the pattern of which can be

[6]Veblen's failure to provide any clear analytical exposition of the concept of cumulative causation has lead to its ignorance in the mainstream as well as in technically more sophisticated camps of heterodox economics, such as complexity theory or complexity economics.

From a theoretical perspective it seems important to recognize that a close connection between Veblen's approach and the concept of routines may be established. In their *An Evolutionary Theory of Economic Change*, Nelson and Winter (1982) made a seminal contribution to economics by introducing Schumpeter's concept of innovation and by developing it along Darwinian lines. However, unlike Schumpeter, they unpacked the intricate notion of innovation by suggesting the concept of routines. Their work gave rise to an enormous and still growing literature on routines, for instance, Lazaric and Raybaut (2005), Vromen (2004), Hodgson and Knudsen (2006), Cohendet and Llerena (2003), or, rediscovering Veblen along micro-meso-macro, Brette and Mehier (2008).

We have introduced the canonical approach of rule, where rule has been defined as any idea with a deductive format for economic operations. The classic Nelson-Winter routine, or "organizational gene", is a rule the carriers of which are subjects in a context that is organized by social and technical rules. A particularity of the term routine is that it refers, at least literally, to a completed process of routinization, or what Veblen called 'habituation'. Human individuals are carriers of cognitive rules that allow them (if routinized) to perform operations in the 'internal environment' of the brain, and of behavioral rules that allow them (if routinized) to perform operations in the 'external environment' of social contexts. See, e.g. Ostrom (2004), Budzinski (2001), Dietrich (2006), Encinar and Munoz (2006), Dopfer and Potts (2008).

described as a logistic curve. The problem arises when this causality principle is applied to a many particle problem. Here, linear causality does not wash. A population is not only an aggregate of individual behaviors, but it (frequently) becomes also an order parameter that feeds back to individual behavior. The application of the linear causality principle excludes a broad range of models subsumed under the term path dependence, and the recognition of the need to include a broader causality concept (that comprises also circularity) marks an essential step towards generalizing Schumpeter's approach into a unified generic architecture of economics.

12 Macro: the seventh chapter

The message economists have to deliver, however, is not mainly measured by the degree of sophistication of the analysis of meso, or any other elementary unit, but rather by the content, originality and validity of the statements about the economy as a whole. Schumpeter addresses the issue explicitly in Chapter 7, entitled "The Economy as a Whole", of the first edition of his "Development Theory". Schumpeter gave rise to high expectations, since he is rightly considered to be a man who had a vision of the 'whole' and an extraordinary talent for 'unification'. He was a scholar of rare intellectual stature, a highly cultured person, widely read, a polymath, with interest in and knowledge of almost everything, an economist who made seminal contributions to all major domains of the discipline, encompassing the history of economic thought as well as theoretical, methodological, historical and statistical analyses. Recognizing his broad vision, he has been heralded by some as the *spiritus rector* of a "unified social science" (Shionoya 1997).

However, Schumpeter's extraordinary abilities to unify, to integrate and to expound connecting principles show up nowhere in his economic theory. Neither in Chapter 7 nor in his other work does he leave any traces of his genius that would demonstrate how the theoretical elements combine into a whole. Schumpeter superscribes Chapter 7 with *'Das Gesamtbild der Volkswirtschaft'*, which means literally, 'The *total* picture of the economy'. This has been translated variously as 'The Economy as a *Whole*', which is nice English prose. However, a note of semantic clarification seems appropriate. Significantly, 'totality' (Schumpeter's Gesamt-) and the 'whole' (translators's Ganzes) are not identical. While the term 'totality' refers to the sum total of factors relevant for the analysis of a phenomenon, the term 'whole' makes an additional statement about how these combine. Schumpeter made in Chapter 7 only two brief remarks about the economy as a whole. He noted, on the one hand, that there are complex interrelationships between the economy and the cultural system, and, on the other hand, that the classical economists were wrong in treating the economy as a whole on the basis of aggregates. As for the remaining part, two thirds are devoted to a *précis* of the essentials of his theory of economic development, and one third to the role of the entrepreneur in the areas of politics and the arts and science. He remarked in the foreword to the

second German edition (Schumpeter 1912/1926) that his "cultural sociology" had "distracted the reader from the problems of dry economic theory", and it is only a natural consequence that eventually he eliminated Chapter 7 in later editions altogether.

The core of Schumpeter's theoretic work is on economic development which, by definition, refers to the economy as a whole. He built his theory of economic development on the concept of the circular flow—elaborated in the opening chapter of his *Economic Development*. The starting point is a stationary state in which the agents follow the "old familiar ways of doing things" and the circular commodity flow repeats its course. Development occurs when energetic entrepreneurs destroy the stationary structure by carrying out new combinations. The entrepreneur "incessantly revolutionizes the economic structure *from within*, incessantly destroying the old one, incessantly creating a new one. This process of Creative Destruction", Schumpeter argues, "is the essential fact about capitalism" (Schumpeter 1942, p. 83). This process runs through all levels of micro-meso-macro. It starts with an entrepreneur who carries out an innovation (micro), develops into a population of agents who imitate it (meso), and consequentially destroys the existing structure of the economy (macro).

How, then, does the incessantly changing structure look? This question relates, first of all, to the structure of the circular flow. The concept of circular flow is consistent with any statement about structure; it is neutral in that it can be defined with or without structure, and different structures can be read into it *ad libitum*—the Physiocrats, in the guise of Francois Quesnay in his *tableau économique*, introduced structure on the basis of a matrix of social classes, and Keynes did so by distinguishing between sub-aggregates that are linked to respective behavioral propensities. In the first chapter, Schumpeter made eclectic references to the classical and pre-classical writers, but did not come up with a comparable coherent framework that would explain the structure of the circular flow.

However, Schumpeter referred frequently to the destruction of equilibrium, and emphasized that the economy actually never is and never can be in equilibrium. The reference here is to Léon Walras. Schumpeter held the view that Walras's general equilibrium theory could be implanted straightforwardly into the circular flow. The limitations of this view become immediately apparent if we consider that the circular flow describes repeating occurrences at both the operant and the generic level. It refers to a physical flow of commodities *cum* money, and a causal circularity in terms of self-reinforcing generic variables. It is the upshot of traditional equilibrium theory that it provides a solution to the coordination problem by keeping the latter constant. What, in Schumpeter's view, is the *magna carta* of economics provides a solution to the coordination problem only at the operant level. It does not furnish us with any generic explanation, since the variables that are expected to do the job are treated exogenously. A *ceteris paribus* clause is not a theory. To assume that general equilibrium theory solves the generic coordination problem is to assert exactly this.

Schumpeter did not ignore structure, but he wrongly assumed that Walras's equilibrium model could solve the generic coordination problem. He accordingly built his theory of development on this premise, and assumed that this would explain the dynamic of structural change. Keynes had a similar belief when he argued that (neo-) classical theory had solved the relative allocation problem, and all that was left to be done was to introduce aggregates and to link them to new behavioral propensities. While Schumpeter thought that the theoretical program of economics could be completed by adding a dynamic chapter, Keynes thought that this task could be accomplished by adding macro economics. They both assumed wrongly that this could be done with general equilibrium theory as the departure point.

13 Hayekian rescue

Hayek recognized that we can cope appropriately with coordination and change in an economy only if we deal with generic knowledge. By exploring the "market as a discovery process", he contributed to the Austrian standard model, and demonstrated how rent-seeking agents and arbitrageurs operate, but he also pioneered a progressive variant of Austrian economics, bringing into theoretic focus the grand theme of generic knowledge growth. Hayek recognized that there was not only an invisible hand at the operant level, which coordinated the activities of the butcher and brewer who exchanged commodities and money, but also at the generic level, where knowledge was divided and needed to be re-coordinated. His departure point was the two first chapters of Smith's *Wealth of Nations*. Hayek recognized the significance of the distinction between operant and generic, and, dealing with the latter, he went beyond Smith's concept of the division of labor, as the following passage reveals:

> ..... (P)rice expectations and even the knowledge of current prices are only a very small section of the problem of knowledge..... The wider aspect of the problem of knowledge..... is the knowledge of the basic fact of how the different commodities can be obtained and used.....and under what conditions they are actually obtained and used, that is, the general question of why the subjective data to the different persons correspond to the objective facts. Clearly there is here a problem of the division of knowledge, which is quite analogous to, and at least as important as, the problem of the division of labour. ..... (This) seems to me to be the really central problem of economics as a social science." (von Hayek 1937, 47)

In his later work, Hayek developed this proposition into a general theory of generic knowledge, upon which he explained the spontaneous emergence of order, self-organization and the evolutionary dynamic of the economic system. The key to all this is the knowledge-processing individual. Given this premise, recourse to the commodity space of general equilibrium theory was an anathema. In Hayek's approach, the individual is not only an endogenous

destroyer in the commodity space, but, above all, a creator, adopter and user of generic knowledge. He could never end up with a model in which the commodities "have spoken", or, in Mill–Sraffa parlance, "the factors of production are the commodities themselves". This exactly is, Hayek argues, what also Schumpeter failed to acknowledge:

> "A recent Statement by Professor Joseph Schumpeter in his *Capitalism, Socialism and Democracy* provides a clear illustration of one of the methodological differences which I have in mind. Its author is pre-eminent among those economists who approach economic phenomena in the light of a certain branch of positivism. To him these phenomena accordingly appear as objectively given quantities of commodities impinging directly upon each other, almost, it would seem, without any intervention of human minds." (von Hayek 1945, p. 529)

It is certainly an irony that Schumpeter, who persistently criticized the classical economists for this fallacy, must now swallow the same blame for his own work.

14 Schumpeter as knowledge agnostic

Where there is smoke, there must be fire. Schumpeter indeed has little to say about knowledge, and the reason for this lies in his particular interpretation of the human individual. He was a pioneer in that he criticized the aggregate view of the classicals and introduced the concept of methodological individualism, and he overcame the narrow confines of neoclassical economics by adding to *homo oeconomicus* an energetic component that brought about change "from within" at the generic level. The limitations of Schumpeter's methodological individualism lie not in its scope, but in its content. He viewed the individual one-sidedly only as an *energetic* personality, not as a knowledge and information processing agent. Though active, the agent he described is not involved in any systematic way in knowledge creation, knowledge adoption or knowledge communication. The energetic personality type relies on a particular social-psychology, the origins of which he nowhere describes. (As with Karl Popper, he rejected psychology as a scientific discipline.) Essentially, he rejected the view that ideas, which are the content of knowledge, should play any role in economic theory. He considered as particularly flawed the notion that development could be explained as the evolution of ideas, and suggested instead that the energetic individual should be put at center stage.

Schumpeter's proposition gains a distinct profile when we apply it to those fields of human culture that we generally associate with the cosmos of ideas, namely, the arts and sciences. In the mentioned Chapter 7, Schumpeter contended that the developments in the arts and sciences depend less on the creation of new ideas as on the ability of energetic personalities to bring them into the public. "The history of science", Schumpeter argued, "shows this dramatically. It is generally so that a new idea is adopted by a powerful

personality and then made to become influential. This personality is not required to be the creator of this idea, just as the entrepreneur who adopts the first time a new production method has not to be necessarily its inventor. What characterizes the leader (Führer) is here, as everywhere, the energy for the deed not that for thoughts. And this function is essential for the development in all fields. A new idea, defenceless as it were, would never get attraction by itself" Schumpeter 1912/1926, 543–544).

He considered his construal not only theoretically sound, but also instrumentally adequate. "It is an advantage of our view that it refers to sizable facts and not to any intangibles such as the 'power of ideas' or any other entities that in their effects cannot be proven" (Schumpeter 1912/1926, 545).

An innovation involves a cognitive process with regard to the creation of a new idea (invention) and an energetic process with regard to its physical actualization. As Schumpeter aptly remarked, an entrepreneur carrying out an innovation brings about a "creative destruction" of the structure of an economy. The well-known metaphoric heuristic acknowledges that both cognition and knowledge (creative) and its physical actualization that changes the structure (destruction) are essential for describing economic development. The peculiarity of Schumpeter's interpretation lies in its treating the creative occurrence in terms of destruction only. Destruction, undoubtedly, is important. In addition, it is, methodologically, most helpful because it does not call for any assumptions about cognition, creativity or ideas. A dog can throw down a vase, and the Taliban can destroy the Buddha statues. Both rely on ignorance. It does not require much knowledge to destroy. However, it does require knowledge to build up. Economic development relies not only on creative *de*-struction, but also on creative *con*-struction. To cope with the category of construction requires that knowledge be a constituent factor of the theory.

15 Generic architecture of economy

Justified as the preceding critique may be, there remains the fact that Schumpeter's work is a major source of inspiration for reconstructing economics. The cornerstone of his contribution is meso. It leads, on the one hand, to the construction of a micro-meso-macro framework challenging the wisdom of the received micro-macro dichotomy, and, on the other hand, to a bimodal principle on grounds of ontological considerations. Macro emerges as a two-level construct that is composed of a "deep" level of ideas or generic rules, and of a "surface" level composed of their physical actualizations.

Concluding from the previous discussion, Schumpeter's theoretical contribution concerns the surface, rather than the deep level of the economy. The energetic entrepreneur adopts a new rule (micro), initiates a new population of rule adopters (meso), and destroys an existing structure (macro). Hayek's contribution, in turn, relates to the knowledge base of the economy, that is, the neural-cognitive disposition of the individual (micro), the process of knowledge diffusion and adoption (meso), and the engendered change

of the economy's division and coordination of knowledge (macro). Clearly, both Schumpeter and Hayek have an important story to tell. Given their complementarity, their works combine into a *unified Schumpeter–Hayek program* that is complete as a platform for generic economic analysis.

In Schumpeter's economics, two terms describing the phenomena of the economy as a whole play a particular role: *structure* and *equilibrium*. How do they fit into the generic architecture outlined? This is a big question, plagued with semantic and basic conceptual issues. We employ in the following brief account only the theoretical categories introduced and supplement them with evolutionary terms generally used in the literature.

Dealing with the deep level, we have a *deep structure* of interrelated ideas. There is a mechanism coordinating the parts into a whole; we associate this with (self-) organization. Analogously, on the *surface level,* we have a surface structure of interrelated physical components stated in terms of actualization processes. The universal measure for macro with a view to the appropriateness of meso components is *generic correspondence*.

Ideas relate to structure; to play their role, they must fit, or must be adapted. For instance, an invention that comes too early is an unadapted one. The individual performance criterion is *adaptiveness*, its micro measure *effectiveness* (not efficiency). The generic correspondence measure for the deep macro structure is *order*.

Schumpeter's circular flow is not deeply structured. There is no mechanism, no self-organization that would coordinate the generic activities of the individuals. There is consequently no measure of generic order.

Physical or matter-energy entities relate to process. To be instrumentally adequate, they must be *efficient.* For instance, a firm producing with minimal cost in an industry is efficient. In meso, micro efficiency is always relative to others, since the individual is a member of a population.[7] The generic correspondence measure for the surface macro structure is *equilibrium*.

The theoretical concept of generic equilibrium can be stated as follows. At any given order, there is a set of potential (p) and of consumed (c) actualizations. There is generic equilibrium if the condition $p - c = 0$ is met. The generic equilibrium conditions apply to all levels: micro, meso, macro. There is general generic equilibrium of the whole economic system if all generic equilibrium conditions of all levels are met. There is generic micro equilibrium if an improvement of a retained generic rule is impossible, for instance, if a firm has perfect Nelson–Winter routines. In a decision theoretic format, marginal learning costs equal marginal benefits from perfecting a routine. There is meso equilibrium if all agents who could and wanted to, actually adopted an idea. The logistic curve of mesoscopic adoptions will have reached its maximum. Finally, there is macro equilibrium, if, at a given constellation of micro and

[7]The generic architecture proposed gives the notion of relative frequency a dual meaning. First, referring to *process*, it can be conceived as relative *meso frequency,* and second, referring to *structure*, as relative *macro frequency*. The issue of relative frequency and its significance for economics has been thoroughly analyzed by Metcalfe (1998, 2002), Metcalfe et al. (2006).

meso equilibria, the relative adoption frequencies of all component parts of the system correspond. There is generic Pareto optimality of the system if all components of all levels are in equilibrium.

The exposition of multi-level equilibria may be supplemented with a set of specific theoretical propositions. At the micro level, equilibria can be expected to be established frequently. The likelihood of reaching equilibrium can be assumed to be decreasing as we go to meso, and from there to macro, with the likelihood of being lowest at macro due to the multitude of parallel processes. Employing this theoretical exposition and its set of differential propositions, we may understand better what Schumpeter may have meant when he said that the capitalist economy can never be and never is in equilibrium. There is no way of reaching this conclusion on the basis of Walrasian general equilibrium theory, since it deals with the operant, not generic, level of the economy.[8]

Developmental change occurs (1) at a deep level as transition from one generic rule to another inducing a change of order, and (2) at a surface level as the new generic rule is adopted destroying an old equilibrium and establishing a new one.

16 Conclusion: you will get a railway

The approach that emerges from Schumpeter's work differs from mainstream economics in that it builds from a set of generic variables, while the latter analyzes operations in a commodity space, keeping the set of former variables constant. In mainstream economics, the micro-macro framework serves well the purpose. Aggregation and disaggregation are mirror procedures, or, as

[8]There exists arguably still no coherent 'evolutionary macro economics' today. However, there is available a number of works that head exactly into that direction. These include for instance a study by Metcalfe et al. (2006) which links self-organization and self-transformation and explains the macro dynamic as emergent property of micro diversity and of meso change. In evolutionary growth models, self-organization and structure are dealt with in a dynamic context (unlike in neoclassical endogenous growth models). Contributions include works by Saviotti and Pyka (2008), Kwasnicka and Kwasnicki (2006), Silverberg and Verspagen (2005), Llerena and Lorentz (2004), Peneder (2004), and Alcouffe and Kuhn (2004), Fagerberg (2003), Verspagen (2002), Foster (1987, 2000).

Other important building blocks of a macro theory refer to the division of knowledge and labor. Building on the legacy of Smith, Petty, Babbage and Storch, recent contributions include works by Leijonhufvud (1995), Loasby (1999), Metcalfe (2002), Helmstädter (2003), Antonelli (2008), Amendola and Gaffard (2003), and Foray (2004), as well as to issues of (macro) distribution, e.g. global distribution by Pyka et al. (1999).

These works are paralleled by developments in agent-based modelling, in which agents are taken to be a bundle of data and behavioral methods, and the objective is to generate particular classes of macro regularities from particular classes of repeated interactions of agents. In the received taxonomy, this will be micro economics, but, considering that the models include all agents, all transactions and all reallocation outcomes of an economy, these and related models may well be conceived as 'macro' economics. The question to be settled is this: how much aggregation do we require for calling an analysis as belonging to macro economics? Contributions to this growing field include works by Pyka and Fagiolo (2005), Tesfatsion (2002), or Bandini et al. (2004).

Samuelson in his textbook says, you can start either with micro or with macro as you see fit. In the generic program, *meso* is central. Meso serves as both structure component and process component, explaining generic structure and generic change. To rely in this program only on micro and macro is like Hamlet without the prince. Schumpeter made the cast complete by laying the foundations and by contributing theoretically to meso. In this way, he has inspired the reconstruction of economics on the basis of a *micro-meso-macro* framework.

While Schumpeter taught us a lesson the full significance of which for economic theory we only gradually come to grasp, his work also has deficits. These, however, can be overcome by acknowledging and further developing the theoretical ideas of Hayek and of Veblen. Depending on the observer's view, they can be combined into a *Schumpeter–Hayek* or a *Schumpeter–Veblen program,* or—acknowledging the relevance of the theoretical ideas of all—into a *unified generic economics program*. It is important to recognize that currently much work is done under the umbrella of evolutionary economics that relates to fields that constitute exactly such a unified program.

The core of the emerging unified generic program is a coherent and consistent treatment of *knowledge*. Schumpeter had a dynamic perspective, and, accordingly, the specific core of his program is new knowledge or innovation. Schumpeter highlighted the essential nature of the phenomenon of economic development by contrasting it to operations in stationary states. As he noted, you may add as many mail coaches as you like, but you will never get a railway. The basic nature of a generic theory can be highlighted by employing analogously this exemplar: add as many operant theories as you please, but you'll never get a generic theory thereby. Let us head for the railway.

Acknowledgements I gratefully acknowledge comments and suggestions by Georg D. Blind, Uwe Cantner, Richard Day, Peter Fleissner, John Foster, Jason Potts, Andreas Pyka, Mike Richardson, Markus Schwaninger, Ulrich Witt, and Charles R. McCann Jr.

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